Claims:

1.   A foot impression generating apparatus for enabling formation of foot impressions, comprising:

     impression platforms including buns of blown open-cell sponge material bonded to and supporting non-porous skins formed of non-blown sponge material wherein the sponge material comprises elastomeric and thermoplastic materials, and wherein the buns and skins are mounted upon a pair of bases having forefoot supporting and angularly elevatable trailing portions; and

     heating and cooling means for heating the impression platforms to a temperature slightly above the melting temperature of the thermoplastic material and then cooling the impression platforms to a temperature below that of the low temperature end of the plastic range of the thermoplastic material.

2.   The foot impression generating apparatus of claim 1 wherein the heating and cooling means comprises:

     a blower equipped with a heating coil similarly to a hair dryer for providing heated and then ambient air to the impression platforms;

     inlet and exhaust vents for circulating the heated and then ambient air through the open-cell sponge material;

     a temperature transducer for providing a signal indicative of the temperature of the heated air; and

     a temperature controller for maintaining the heated air at a selected temperature slightly above the melting temperature of the thermoplastic material in response to the signal from the temperature controller, wherein a flow of the heated air is provided via turning the blower on and controlling a electrical current flowing through the heating coil, and then a flow of cooling ambient air is provided by turning the electrical current off.

3.   The foot impression generating apparatus of the second aspect additionally comprising a damper activated air re-circulation system for recovering heated air and re-circulating it through the open-cell sponge material.

5

4.   A method of creating foot impressions representative of the bottom foot contours of a consumer's feet via utilization of foot impression generating apparatus configured in accordance with claim 1 wherein the method comprises the steps of:

10   heating the impression platforms slightly above the melting temperature of the thermoplastic material;

angularly elevating the trailing portions to a selected angular elevation angle representative of the selected foot impression forming position;

15   the consumer stepping into the impression platforms thereby deforming the buns and skins in an elastomeric manner and thus forming foot impressions in conformance with the shape of his or her feet at the selected foot impression forming position;

cooling the impression platforms to a temperature below that of

20   the low temperature end of the plastic range of the thermoplastic material; and

the consumer removing his or her weight and feet from the impression platforms thus leaving the consumer's foot impressions as taken at the selected foot impression forming position.

25

5.   The foot impression generating apparatus of the claim 1 additionally comprising non-contacting scanning means for creating digital "point cloud data" representative of the foot impressions.

30   6.   A method of creating digitized foot impressions representative of the bottom foot contours of a consumer's feet via

utilization of foot impression generating apparatus configured in accordance with claim 5 wherein the method comprises the steps of:

heating the impression platforms slightly above the melting temperature of the thermoplastic material;

5   angularly elevating the trailing portions to a selected angular elevation angle representative of the selected foot impression forming position;

the consumer stepping into the impression platforms thereby deforming the buns and skins in an elastomeric manner;

10   cooling the impression platforms to a temperature below that of the low temperature end of the plastic range of the thermoplastic material;

the consumer removing his or her weight and feet from the impression platforms;

15   scanning the contours of the foot impressions;

creating digital data representative of the contours of the foot impressions as formed at the selected foot impression forming position; and

storing the digital data as digitized foot impressions.

20

7.   The foot impression generating apparatus of claim 5 additionally comprising foot alignment means having lateral positioning gates juxtaposed to selected foot impression positions for a consumer's great toe metatarsal heads, and adjustable form fitting longitudinal

25   gates juxtaposed to selected foot impression positions for the rear of the consumer's heels.

8.   A method of creating digitized foot impressions representative of the bottom foot contours of a consumer's feet via

30   utilization of foot impression generating apparatus configured in accordance with claim 7 wherein the method comprises the steps of:

64

measuring the distances between the great toe metatarsal heads and the rear of the heels of the consumer's feet;

setting the foot alignment apparatus in a matching manner;

heating the impression platforms slightly above the melting

5   temperature of the thermoplastic material;

angularly elevating the trailing portions to a selected angular elevation angle representative of the selected foot impression forming position;

positioning the impression platforms to an initial position whereat

10   the trailing portions are nominally horizontal;

further angularly elevating either trailing portion at an appropriate supplemental elevation angle in order to compensate for a short leg in the event that the consumer has one leg shorter that the other;

the consumer aligning his or her feet with reference to the foot

15   alignment apparatus before stepping into the impression platforms;

the consumer stepping into the impression platforms thereby deforming the buns and skins in an elastomeric manner;

forwardly rotating the impression platforms to the selected foot impression forming position whereat the consumer forms foot

20   impressions in conformance with the shape of his or her feet at the selected foot impression forming position;

re-measuring the distances between the great toe metatarsal heads and the rear of the heels of the consumer's feet with the foot alignment apparatus;

25   cooling the impression platforms to a temperature below that of the low temperature end of the plastic range of the thermoplastic material;

rotating the back to its initial position;

the consumer removing his or her weight and feet from the

30   impression platforms;

scanning the contours of the foot impressions;

creating digital data representative of the contours of the foot impressions as formed at the selected foot impression forming position; and

storing the digital data as digitized foot impressions along with

5   the re-measured distances between the great toe metatarsal heads and the rear of the heels of the consumer's feet as a set of data representative of the contours of the consumer's foot impressions as taken at the selected foot impression forming position.

10   9.   A method of creating a composite set of digitized foot impressions representative of a selected blending of at least two sets of data representative of the contours of a consumer's foot impressions, where each of the at least two sets of data have previously been determined at selected foot impression forming positions according to

15   the method of claim 8, comprises the steps of:

compressionally distorting the digitized foot impression or impressions data comprised in the set or sets of data representative of the contours of a consumer's foot impressions taken at the lessor trailing portion angle or angles over the rear portion of the distance from

20   the great toe metatarsal heads to the rear of the heels such that the resulting distance between the great toe metatarsal heads and the rear of the heels comprised in the set or sets of the so modified digitized foot impression data is or are equal to that of the set of data representative of the contours of the consumer's foot impressions taken at the greater

25   trailing portion angle;

positioning the sets of so modified digitized foot impression data progressively along the longitudinal axis of the composite set of digitized foot impressions with the digitized data from the set of data representative of the contours of the consumer's foot impressions taken

30   at the largest trailing portion angle positioned forwardly and those taken at the smallest trailing portion angle rearwardly with the respective sets of digitized data generally disposed to either side of a mean average

66

angularly skewed line or lines extending from inside to outside of the composite set of digitized foot impressions in a generally forward direction or directions; and

5
establishing transition zones on either side of the mean average line or lines such that there is a smooth transition between digitized data from the set of data representative of the contours of the consumer's foot impressions taken at the largest trailing portion angle generally present from the forward portion of the instep through the forefoot supporting regions to digitized data from the set of data

10
representative of the contours of the consumer's foot impressions taken at the smallest trailing portion angle generally present from the rear of the fifth metatarsal through the heel regions, with the fully implemented composite set of digitized foot impressions along with the consumer's identification, shoe type and size, and any supplemental elevation angle

15
utilized in a personal file ready for use in shoe insert generating apparatus.

20
10.   A method of forming shoe inserts for a consumer via utilization of a digitally controlled milling machine equipped with a laterally rotated milling spindle and a dovetail cutter having an apex radius smaller than any anticipated shoe insert feature radius, and having a software library of typical shoe last bottom geometries, comprises the steps of:

25
providing data indicative of the contours of the consumer's digitized foot impressions, shoe type and size, the trailing portion angle utilized, and any other details unique to the consumer such as a supplemental elevation angle for accommodating a shorter leg;

30
subtracting scaled corrections of a selected one of the typical shoe last bottom geometries stored in the library from the digitized foot impressions;

positioning the digitized foot impressions with reference to the table of the digitally controlled milling machine;

selecting an appropriately sized pair of shoe insert blanks;

selecting an appropriate set of shoe insert blank supporting devices for holding the shoe insert blanks as required for maintaining proper minimum clearance values in the forefoot portions of the digitized foot impressions;

5

forming the shoe insert contours in the digitally controlled milling machine with the milling spindle in conformance with the digitized foot impressions less scaled corrections of the selected one of the typical shoe last bottom geometries;

10

removing the shoe inserts from the shoe insert blank supporting devices;

covering the shoe inserts with material suitable for interfacing with the feet; and

presenting or shipping the finished shoe inserts to the consumer.

15

11.   The method of claim 10 wherein the digitally controlled milling machine is additionally equipped with a gimbal mounted router head with a dovetail cutter having a dovetail cutter angle greater than any anticipated instep contour angle and the library additionally

20   comprises typical shoe insert edge contours, wherein the method additionally includes the steps of:

cutting edge contours of the shoe inserts with the gimbal mounted router head in conformance with scaled versions of the stored shoe insert edge contours in a manner such that the apex

25   circumference of the dovetail cutter just misses the shoe insert blank supporting devices leaving a slight amount of "flash" surrounding the bottom surface of the shoe inserts; and

removing the flash before presenting or shipping the finished shoe inserts to the consumer.

30

12.   A method of forming shoe inserts for a consumer via utilization of a digitally controlled milling machine equipped with a

68

laterally rotated milling spindle and a dovetail cutter having an apex radius smaller than any anticipated shoe insert feature radius, and having a software library of typical shoe last bottom geometries, comprises the steps of:

5   providing data indicative of the contours of the consumer's digitized foot impressions, shoe type and size, the trailing portion angle utilized, and any other details unique to the consumer such as a supplemental elevation angle for accommodating a shorter leg;

        subtracting scaled corrections of a selected one of the typical
10   shoe last bottom geometries stored in the library from the digitized foot impressions;

        positioning trailing portions of the digitized foot impressions with reference to the table of the digitally controlled milling machine;

        selecting an appropriately sized pair of shoe insert blanks;
15   selecting an appropriate set of shoe insert blank supporting devices for holding the shoe insert blanks as required for maintaining proper minimum clearance values in the forefoot portions of the digitized foot impressions;

        entering tool radius compensation offset correction values to be
20   used in forming the trailing portions of the shoe insert contours, and reduced tool radius and fictitious tool radius compensation offset correction values to be used in forming the forefoot supporting portions of the shoe insert contours into the digitally controlled milling machine;

        forming the shoe insert contours in the digitally controlled milling
25   machine with the milling spindle in conformance with the digitized foot impressions less scaled corrections of the selected one of the typical shoe last bottom geometries;

        removing the shoe inserts from the shoe insert blank supporting devices;

30   covering the shoe inserts with material suitable for interfacing with the feet; and

        presenting or shipping the finished shoe inserts to the consumer.

13.   The method of claim 12 wherein the digitally controlled milling machine is additionally equipped with a gimbal mounted router head with a dovetail cutter having a dovetail cutter angle greater than any anticipated instep contour angle and the library additionally comprises typical shoe insert edge contours, wherein the method additionally includes the steps of:

cutting edge contours of the shoe inserts with the gimbal mounted router head in conformance with scaled versions of the stored shoe insert edge contours in a manner such that the apex circumference of the dovetail cutter just misses the shoe insert blank supporting devices leaving a slight amount of "flash" surrounding the bottom surface of the shoe inserts; and

removing the flash before presenting or shipping the finished shoe inserts to the consumer.